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EXAMINER

LOUIE, WAI SING

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 03/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/476,558

Applicant(s)

HU, YONGJUN

Examiner

Wai-Sing Louie

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 August 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 16, 18, 20-33 and 36-44 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16, 18, 20-33 and 36-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 14. 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 16, 18, 26, 32-33, 36, and 41-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brady et al. (US 5,066,615) in view of Finley et al. (US 5,552,180), newly cited.

With regard to claims 16, 18, 32, and 42-44, Brady et al. disclose a semiconductor structure (col. 2, line 39 to col. 6, line 65 and fig. 1) comprising:

- A semiconductor substrate 11;
- An ARC 21 having a thickness range from 125 and 750 Å (col. 4, lines 58-59);
- An ARC 21 over the semiconductor substrate comprises a metal silicon nitride (col. 3, line 24), and the metal is selected from the group consisting of Ti, Zr, Mo, Ta, and W (col. 3, lines 23-27), but do not disclose the metal is selected from the group consisting of Sc, Co, and Ni. However, Finley et al. disclose silicon can be alloyed or doped with many different elements to target the properties of coating such as silicon-nickel nitride (Finley col. 3, lines 20-32 and col. 3, line 53 to col. 4, line 3). Finley et al. teach silicon alloy dielectric used for coating prevents breakdown during heating and the coating is antireflecting from the film side

(Finley col. 3, lines 20-30 and col. 7, lines 37-40). Therefore, it would have been obvious to one with ordinary skill in the art to modify Brady's antireflecting coating with the teaching of Finley et al. to apply silicon-nickel nitride coating in order to prevent breakdown of coating during heating and to provide an antireflective coating.

With regard to claim 26, Brady et al. modified by Finley et al. disclose a semiconductor structure comprising:

- A semiconductor substrate 11;
- An ARC upon the semiconductor substrate, the ARC composing a metal silicon nitride  $M_xSi_yN_z$  (see claim 16), where:
  - X is greater than zero (col. 3, line 62);
  - Y could be greater than x;
  - Z is greater than zero and less than 5y (see above formula);
  - M is at least two transition metal composed of  $M_1M_{2(1-r)}$  (see claim 16);
  - R could be in a range 0 to 1;
  - M1 and M2 are Ni and Al (Finley col. 3, lines 20-32);
  - M1 is not M2 (Finley col. 3, lines 20-32).

With regard to claim 33, in addition to structure disclosed in claim 26 above, Brady et al. also disclose:

- Metal silicide binary compound is  $M_1M_{2(1-r)}Si_s$  (Finley col. 3, lines 20-32);
- M1 and M2 are selected from the group listed in claim 41 below.

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With regard to claim 36, Brady et al. disclose the metal silicide binary compound is  $M1_xSi_y$  and M is tungsten, where x could be 1 and y could be 1.5 to 5 (col. 2, line 10).

With regard to claim 41, Brady et al. disclose the metal silicon nitride (MSiN) used for ARC compound (col. 3, line 24), but do not disclose the metal is selected from the group consisting of titanium aluminum silicon nitride and tungsten aluminum silicon nitride. However, Finley et al. silicon can be alloyed or doped with many different elements to target the properties of coating such as titanium aluminum silicon nitride (Finley col. 3, lines 20-32). Finley et al. teach silicon alloy dielectric used for coating prevents breakdown during heating and the coating is antireflecting from the film side (Finley col. 3, lines 20-30 and col. 7, lines 37-40). Therefore, it would have been obvious to one with ordinary skill in the art to modify Brady's antireflecting coating with the teaching of Finley et al. to apply silicon-nickel nitride coating in order to prevent breakdown of coating during heating and to provide an antireflective coating.

Claims 20-25, 27-31, and 37-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brady et al. (US 5,066,615) in view of Niroomand et al. (US 5,886,391).

With regard to claims 20, 23, 28, 31, and 37-38, Brady et al. disclose the ARC layer has a thickness of 300 Å (col. 4, line 48) and is amorphous silicon (col. 5, line 53). Brady et al. do not disclose the ARC is composed of hemispherical grained polysilicon. However, Niroomand et al. disclose the polysilicon layer is a rough or hemispherical grained layer (Niroomand col. 9, line 25). Niroomand et al. teach the rough grained layer scatter the unabsorbed light (Niroomand col. 9, lines 15-20). Hence, it would have been obvious to one with ordinary skill in the art to modify

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Brady's device with the teaching of Niroomand et al. to provide a hemispherical grained polysilicon layer in order to provide an antireflection layer to scatter the unabsorbed light.

With regard to claims 21 and 22, Brady et al. disclose the metal silicon nitride used in the invention expressing as  $M_x$ -silicon-nitride (col. 6, line 12), but do not disclose  $X > 0$ ,  $Y > 2X$ , and  $Z = (1 \text{ to } 2)Y$ . One with ordinary skill in the art would have known the formula for the silicon nitride is  $Si_3N_4$ . Therefore, it is obvious that  $Y$  is greater than  $2X$  and  $Z$  greater than  $1Y$  in the formula of  $M_x(Si_3N_4)$ .

With regard to claims 24 and 39, Brady et al. disclose the relative reflectivity of various compounds comparing to aluminum over a significant wavelength range in fig. 6. the relative reflectivity in 380 nm wavelength is in about 15-20% (col. 4, lines 32-50 and fig. 6).

With regard to claims 25 and 40, Brady et al. disclose the ARC is used in photolithographic process (col. 1, lines 14-15). One with ordinary skill in the art would have known that ARC applies to the photolithographic process for masking and etching opening, groove, trench and other features on a semiconductor substrate. Hence, it is obvious the trench, well and other features on a substrate are included.

With regard to claims 27 and 30, Brady et al. disclose the ARC has a thickness of 300 Å (col. 4, line 48).

With regard to claim 29, in addition to structure disclosed in claim 26 above, Brady et al. also disclose:

- An electrically insulative layer 12 on a semiconductor substrate (fig. 1);
- A patterned electrically conductive metal line 13 on the electric insulative layer (fig. 1).

*Response to Arguments*

Applicant's arguments filed 8/30/02 have been fully considered but they are not persuasive.

- Applicant argues that reference Brady et al. and Wolfe et al. do not disclose or suggest silicon-alloy nitride includes at least one metal selected from the group consisting of Sc, Co, and Ni. However, Wolfe et al. is no longer used in the above rejection. The argument is moot.
- Applicant argues Brady et al. and Fan et al. do not teach or suggest an antireflective coating compound selected from the group consisting of titanium aluminum silicon nitride and tungsten aluminum silicon nitride. However, Fan et al. is no longer used in the above rejection. The argument is moot.

*Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

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CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

wsl

February 24, 2003

  
LONG PHAM  
PRIMARY EXAMINER